

## A NOTE ON THE CLASSIFICATION OF MICROSPHAERA MOUGEOTII LÉV.

par H.J. BOESEWINKEL\*

SUMMARY. — A study of the conidial state of powdery mildew of *Lycium chinense* in New Zealand indicates that it cannot be classified in *Microsphaera* as in common practice but that it belongs in *Erysiphe*. A study of the type material in Paris, which includes both the imperfect and the perfect state, confirms that the New Zealand collection is identical with *Microsphaera mougeotii* and confirms DE BARY's statement that LÉVEILLÉ did not provide an adequate drawing of the perithecia. The characteristics of the perithecial appendages and two-spored asci do not belong in *Microsphaera* but fit *Erysiphe*. There is no need to create a new genus to accommodate this powdery mildew on *Lycium* and until further progress has been made with the classification of Erysiphaceae this species should be called *E. mougeotii* (Lév.) de By.

RÉSUMÉ. — L'étude des stades imparfaits et parfaits du type de *Microsphaera mougeotii* Lév. du Muséum National d'Histoire Naturelle, Paris, confirme que la collection néo-zélandaise sur *Lycium chinense* représente le stade conidien de *M. mougeotii*. Cette étude confirme aussi l'opinion de DE BARY selon laquelle le dessin des périthèces, par LÉVEILLÉ, est totalement insuffisant. Les caractéristiques du stade parfait, surtout des fulcres nombreux et des asques bispores, ont appartenir l'échantillon plutôt au genre *Erysiphe* qu'au genre *Microsphaera*.

L'étude du stade conidien en Nouvelle-Zélande montre que sa classification habituelle dans le genre *Microsphaera* n'est pas appropriée en raison de la production de conidies en chaînes et de la présence de suçoirs arrondis, non lobés. Cependant, ces caractéristiques sont conformes au genre *Erysiphe*. Comme les deux stades, parfaits et imparfaits, appartiennent au genre *Erysiphe*, la création récente du genre *Arthrocladiella* pour l'espèce sur *Lycium* est inutile. Confirmant l'opinion de DE BARY, l'auteur conserve pour cette espèce cosmopolite, le nom de *E. mougeotii* (Lév.) de By.

\* Plant Health Diagnostic Station, Mt Albert Research Centre, Private Bag, Auckland, New Zealand.

## INTRODUCTION

The name *Microsphaera mougeotii* Lév. is frequently applied to a species of powdery mildew on *Lycium barbarum* L., *L. europaeum* L. (LÉVEILLÉ, 1851), *L. ovatum* Poir., *L. ruthenicum* Murr. (SALMON, 1900), *L. chinense* Mill. (YEN and WANG, 1973) and *L. rhombifolium* (BLUMER, 1933, 1967). Its classification within *Microsphaera* is not justified as it is based only on the characteristics of the perithecial appendages which are not at all typical of that genus. SALMON (1900) remarked that *M. mougeotii* differed from all other species of the genus *Microsphaera* in the densely crowded, widely branched appendages and the possession of two-spored asci. GOLOVIN (1956) placed the fungus in *Arthrocladia* and mentioned that the appendages were branched regularly with septa at the nodes reminiscent of *Penicillium* or *Gladophora* conidiophores. VASSILKOV (1960) considered that the appendages were articulate and so different from *Microsphaera* that he proposed the new genus *Arthrocladiella* with the only species *A. lycii* (Lasch) Vassilk. In 1963 VASSILKOV changed the name into *A. mougeotii* (Lév.) Vassilk. VASSILKOV did not describe or illustrate the conidial state or the appendages which, according to DE BARY (1870), are more densely crowded than on the illustration by LÉVEILLÉ in 1851. Classification of Erysiphaceae is based on the morphology of the perithecia and those of *M. mougeotii*, which were frequently found before the time of DE BARY, have been rare during the last 100 years (DE BARY, 1870; BLUMER, 1967). However, DE BARY (1870) noted that this species on *Lycium*, which he referred to as *Erysiphe mougeotii*, can be recognised by the well developed mycelium, the typically unlobed appressoria and the short cylindrical conidia. While many plants are host to several species of powdery mildew of which the imperfect states have been confused because their characteristics are not well known, it is difficult to mistake *E. mougeotii* which is well characterised by the features mentioned by DE BARY.

Although *Lycium* can be infected also by *M. diffusa* Cooke & Peck (SALMON, 1900) and *Sphaerotheca pannosa* (Wallr. ex Schlecht.) Lév. (Anonymous, 1960), their imperfect states are different. *M. diffusa* has lobed appressoria and larger, singly produced conidia whereas *S. pannosa* has longer chains of ovoid conidia which contain conspicuous fibrosin bodies.

## RESULTS AND DISCUSSION

The imperfect conidial state on *Lycium chinense* in New Zealand (fig. 1) possesses the characteristics described and illustrated by DE BARY (BOESEWINKEL, 1979). The dense, white, amphigenous mycelium produces numerous unlobed, nipple-shaped, appressoria of 5-7  $\mu$ m wide. The conidiophores of 55-125 x 7.5-12  $\mu$ m produce conidia of a characteristic shape and size in long or short chains. The conidia are oblong-cylindric with nearly flattened ends, less frequently ovoid or barrel-shaped, and measure (20-) 27.5 (-38) x (10-) 13.7



Fig. 1. - Conidiophore of *M. mougeotii* on *Lycium chinense* in New Zealand, x 600.

(-19)  $\mu\text{m}$ . No conspicuous fibrosin bodies are present but occasionally granular bodies up to  $1\mu\text{m}$  diameter can be observed. Germ tubes are produced at the ends, less frequently at the sides of conidia and terminate in an unlobed appressorium. There have been few illustrations or descriptions of the imperfect state since DE BARY (1870). FOEX (1925) studied 3-5 celled conidiophores and conidial germination on *L. barbarum* in France. HOMMA (1937) remarked that the numerous collections on *L. chinense* in Japan produced conidia in perfect chains, according to which the fungus belonged in *Erysiphe* rather than in *Microsphaera*. JORSTAD (1962) mentioned that on *L. europaeum* in the Canarian Islands the conidia are produced in a chain and the same observation was made on *L. chinense* in Formosa (YEN and WANG, 1973). To remove any doubt whether the imperfect state in New Zealand belongs to *M. mougeotii* Lév. and to verify DE BARY's statement that LÉVEILLÉ provided an inadequate illustration, I studied the type material on *L. europaeum* L. which LÉVEILLÉ collected in 1848 in Vaugirard, France and which is held in Paris. Furthermore I examined a range of samples from France and Germany identified by DE BARY, MAGNUS, TULASNE, HARIOT and others. The perithecial characteristics of the type were in good condition and not entirely like the illustration given by LÉVEILLÉ (1851) but in agreement with the

description by DE BARY (1870) and nearly like the illustration by BLUMER (1933) (fig. 2). The perithecia are globose with a flattened base, 100-160 $\mu$ m wide and 100-110 $\mu$ m high. The outer cells of the perithecial wall are 10-15 $\mu$ m wide. From the upper half of the perithecia 50 or more appendages arise which

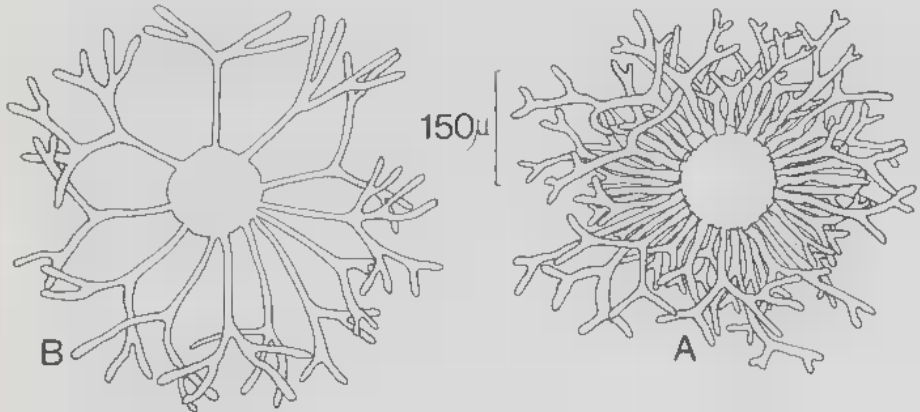


Fig. 2. — A: Perithecia drawn from the type; B: after LÉVEILLÉ.

are septate at the base, hyaline, thin-walled and 1-3, rarely 4 times dichotomously branched at about half way their length. For some unexplained reason, LÉVEILLÉ drew only 12 appendages. Their width was found to be greater than suggested by the illustration of BLUMER as they are 5-7.5 $\mu$ m wide with occasional swollen areas of 7-8.7 $\mu$ m wide (fig. 3). The perithecia contain about

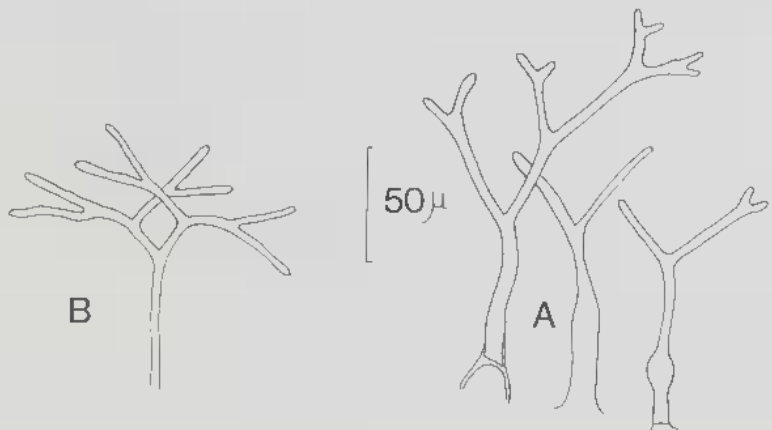


Fig. 3. — A: Appendages drawn from the type; B: after LÉVEILLÉ.

12-20 asci which produce 2 ascospores. The conidial state of the type was in good condition and possessed mycelial cells of (25-) 37-50 $\mu$ m long with unlobed nipple-shaped appressoria, conidiophores producing conidia in long or short chains and characteristic cylindrical conidia of 20-35 x 10-12.5 $\mu$ m. These typically shaped conidiophores of the type are identical to those present in New Zealand (fig. 1) but cannot be recognised from the illustrations by FOEX (1925) and YEN and WANG (1973). It is obviously difficult to draw the subtle morphological features of the imperfect state.

According to the characteristics of the perfect state the species on *Lycium* apparently does not belong in the genus *Microsphaera* where perithecia usually contain fewer than 12 asci, more than 2 ascospores and where the not very numerous appendages are branched, and often typically broadened near the tip. The characteristics of the perfect state of *M. mougeotii* occur, however, in the genus *Erysiphe*.

Although usually only the perfect state is used in classification of powdery mildews, the imperfect states of typical representatives of a genus often have characteristics in common which may be help in identification. Lobed appressoria and singly produced conidia are characteristics commonly found in species of *Microsphaera* (BOSEWINKEL, 1976). As the appressoria of *M. mougeotii* are never lobed (DE BARY, 1870; YEN & WANG, 1973) and the conidia often formed in long chains (YEN & WANG, 1973) it also differs in this respect from species of *Microsphaera* but is similar to several species of *Erysiphe*. According to the characteristics of both the imperfect and perfect states, powdery mildew of *Lycium* should be placed in *Erysiphe*, the appropriate name being :

- Erysiphe mougeotii* (Lév.) de By, Abh. Senckenb. naturf. Ges. 7: 412, 1870.
- = *Erysiphe lycii* Lasch, Klotzsch Herb. myc. 950, 1846 (nomen nudum).
- = *Microsphaera mougeotii* Lév., Ann. Sci. Nat., bot. 3 sér., 15: 158 and 381, 1851.
- = *Podosphaera mougeotii* (Lév.) Quél., Champ. Jur. Vosg. 3: 106, 1875.
- = *Microsphaera lycii* (Lasch) Sacc. & Roum., *Michelia* 2: 310, 1881.
- = *Arthrocladia lycii* (Lasch) Golov., *Pl. crypt.* 10: 310, 1956.
- = *Arthrocladiella mougeotii* (Lév.) Vassilk., *Bot. mater. otd. spor. rast.* 16: 112, 1963.

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